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| To: |  | <i>New York State Department of Transportation</i> ENGINEERING INSTRUCTION | EI 08-044 |
| Title: SPECIAL SPECIFICATIONS FOR HOT MIX ASPHALT (HMA) PAVEMENT RIDE QUALITY, LEVELS 1 AND 2 | | | |
| Distribution: <input type="checkbox"/> Manufacturers (18) <input type="checkbox"/> Surveyors (33) <input type="checkbox"/> Local Govt. (31) <input checked="" type="checkbox"/> Consultants (34) <input checked="" type="checkbox"/> Agencies (32) <input checked="" type="checkbox"/> Contractors (39) <input type="checkbox"/> _____ () | | Approved: <u>/s/Robert L. Sack</u> <u>6 Dec 08</u> Robert L. Sack, P.E. Date Deputy Chief Engineer, Research | |

ADMINISTRATIVE INFORMATION:

- This Engineering Instruction (EI) is effective beginning with projects submitted for the letting of May 7, 2009.
- EI 05-017 is superseded by this issuance.
- The special specifications transmitted by this EI will reside in the Special Specifications directory of the Toolbox server.

PURPOSE: The purpose of this EI is to transmit updated special specifications to include Pavement Ride Quality items with Hot Mix Asphalt (HMA) specifications.

TECHNICAL INFORMATION: The pavement ride quality specifications for Level-1 and Level-2 have been updated to incorporate several changes. The most significant changes include:

- A lot “measurement” will be the average International Roughness Index (IRI) value of both wheel paths instead of just the right wheel path,
- testing exclusion areas have been more specifically defined,
- the specification has been converted to U.S. Customary Units from Metric Units.

While the Department makes the transition from Metric Units to U.S. Customary Units, versions of the specifications in each Unit will be available. Both versions are transmitted with this EI.

Design Guidance for ride quality projects has also been updated and is being issued under EI 08-045, Design Guidance for Hot Mix Asphalt (HMA) Pavement Ride Quality Projects.

In addition to the specification, there are two supplemental documents. Test Method NY402-01F – Measuring International Roughness Index with an Inertial Profiler contains definitions, descriptions of equipment requirements, weather requirements, and testing procedures. Materials Method 24.1 – Inertial Profiler Calibration and Verification details the responsibilities of the Department and contractors, specifies procedures to ensure proper equipment performance and data collection, reporting methods and verification procedures. TM 402-01F can be found at

http://www.dot.state.ny.us/tech_serv/mat/manuals/tm40201.pdf and MM24.1 can be found at http://www.dot.state.ny.us/tech_serv/mat/manuals/mm241-03-interim.pdf.

IMPLEMENTATION:

- The Designer will insert the transmitted special specifications into contract proposals beginning with projects submitted for the letting of May 7, 2009.
- The following specification item numbers are disapproved by this EI:

| | |
|--------------|------------------------------------------|
| 402.00004118 | Pavement Ride Quality Adjustment Level 1 |
| 402.00005118 | Pavement Ride Quality Adjustment Level 2 |
| 402.00004391 | Pavement Ride Quality Adjustment Level 1 |
| 402.00005291 | Pavement Ride Quality Adjustment Level 2 |
| 402.00005391 | Pavement Ride Quality Adjustment Level 2 |
| 402.00005491 | Pavement Ride Quality Adjustment Level 2 |
- The following new special specification item numbers are approved by this EI:

| | |
|-----------------------|------------------------------------------|
| <u>U.S. Customary</u> | |
| 402.00004218 | Pavement Ride Quality Adjustment Level 1 |
| 402.00005218 | Pavement Ride Quality Adjustment Level 2 |
| <u>Metric</u> | |
| 402.00004218 | Pavement Ride Quality Adjustment Level 1 |
| 402.00005218 | Pavement Ride Quality Adjustment Level 2 |

TRANSMITTED MATERIALS: The following special specifications are attached to this EI:

| | |
|--------------|------------------------------------------|
| 402.00004218 | Pavement Ride Quality Adjustment Level 1 |
| 402.00005218 | Pavement Ride Quality Adjustment Level 2 |
| 402.00004218 | Pavement Ride Quality Adjustment Level 1 |
| 402.00005218 | Pavement Ride Quality Adjustment Level 2 |

BACKGROUND: The Ride Quality program was developed in order to provide higher quality pavements. National research has proven that smoothly built pavements will stay smooth longer, last longer, reduce user costs as a result of improved fuel efficiency and reduced vehicle maintenance costs, and improve user satisfaction. New York's pavements consistently rank among the roughest of all states in the country as determined by the measurements of the National Highway System. The Department is committed to improve its rankings, as well as improve the overall condition of New York highways.

CONTACT: For additional information regarding the new special specifications for HMA pavement ride quality, contact Chad Corbett of the Materials Bureau at (518) 485-6096, or ccorbett@dot.state.ny.us.

ITEM 402.00004218 PAVEMENT RIDE QUALITY ADJUSTMENT LEVEL 1
ITEM 402.00005218 PAVEMENT RIDE QUALITY ADJUSTMENT LEVEL 2

DESCRIPTION

Measure the ride quality of the finished riding surface using a verified and properly calibrated inertial profiler. Report test results to the Engineer as an average International Roughness Index (IRI) for the left and right wheelpaths of each pavement-ride-quality (PRQ) lot.

For the purposes of this specification, the following terms are defined below.

Calibration. All procedures contained in Materials Method 24.1 shall be followed to ensure that each individual data collection device is operating properly.

International Roughness Index (IRI). An index computed from a longitudinal profile measurement reported in in/mi. IRI is computed according to the quarter-car model which indicates the amount of suspension travel that one wheel of a standard vehicle would experience when traveling over a longitudinal profile.

Measurement. The average determination of IRI along the reference lines (left and right wheelpaths) for the entire length of a single PRQ lot in the direction of traffic.

Multiple-Course. Two or more paving courses, excluding truing and leveling.

Pavement Ride Quality (PRQ) Lot. A PRQ lot is a continuous 528 ft (1/10th mile) section of pavement one lane wide, in areas shown in the contract documents as requiring pavement ride quality testing. Ride Quality testing is performed and payment adjustments are made separately for each PRQ lot.

Quarter-car Model. A mathematical model of one wheel (one quarter) of a car of a standard weight with a standard tire, standard spring rate, and standard damping as established in NCHRP Report 228.

Reference Lines. The imaginary lines the noncontact-height sensors trace along the pavement surface. The intended reference lines for all Quality Control (QC) and Quality Assurance (QA) tests are located approximately 3 ft to either side of the center line of the lane (left and right wheelpaths). The closer all tests are taken to the same reference lines, the less variability will occur between the results.

Single-Course. One paving course, excluding truing and leveling.

Test. The average of three consecutive measurements taken on the same day in the same PRQ lot by the same inertial profiler and operator.

Verification. All procedures contained in Materials Method 24.1 to be followed to ensure the test results produced by a profiler are within an acceptable variation of the true profile.

MATERIALS None Specified

ITEM 402.00004218 PAVEMENT RIDE QUALITY ADJUSTMENT LEVEL 1

ITEM 402.00005218 PAVEMENT RIDE QUALITY ADJUSTMENT LEVEL 2

CONSTRUCTION DETAILS

Test and report the ride quality of all new flexible pavement and HMA overlays of pavement and bridge decks except:

- sections less than 1,320 feet in length,
- sections within 200 feet of any traffic control device or intersection,
- tapered sections less than a full lane-width,
- ramps with posted speed less than 40 mph,
- 25 feet from concrete-surfaced bridge decks and approach slabs,
- individual PRQ lots that contain castings, grates, frames or other similar objects embedded within the travel lane – omit the measurement of the wheelpath closest to the object for the one PRQ lot in which it falls,
- shoulders, gore areas, turn-outs, turn-arounds, driveways, parking areas, other similar miscellaneous paving.

All new pavement, including the areas excluded from ride quality testing listed above, is subject to the provisions of §402-3.10 Surface Tolerance.

A. Inertial Profiler Requirements. A self-powered test vehicle conforming to ASTM E950 Class I and AASHTO MP 11-03 containing automated test initiation and data recording systems capable of providing the following information to the on-board display, on-board data storage device, and on-board printer.

- The date, time, contract number, route, location, test direction, lane, and operator for each test.
- The equipment parameters related to calibration.
- A general profile, using a scale of 1:300 horizontal and 1:1 vertical.
- The average IRI and range for both wheelpaths for each PRQ lot.

Alternative equipment types may be used as approved by the Director, Materials Bureau. Submit requests to use alternative equipment at least 14 days prior to the start of QC testing. Alternative equipment must meet the inertial profiler requirements to be approved.

B. Equipment Verification, Calibration, and Daily Control Section Testing.

- 1. Verification.** Prior to using an inertial profiler on a Department contract, verify the profiler according to Materials Method 24.1.
- 2. Calibration.** Calibrate the inertial profiler according to frequency and procedures given in Materials Method 24.1.
- 3. Daily Control Section Testing.** Create a control section at or near the contract site according to the procedures of Materials Method 24.1. Each day of quality control testing, perform one measurement on the control section. Record the results and track the performance of the inertial profiler in accordance with the procedures of Materials Method 24.1.

C. Quality Control (QC) Measurements.

- 1. Layout PRQ Lots.** Divide the surface-course pavement areas designated in the contract documents as requiring pavement ride quality testing into PRQ lots according to the following:
 - Divide pavement constructed into PRQ lots 528 ft long and one lane wide. PRQ lots may include pavement placed on more than one day.
 - Each PRQ lot must be continuous. PRQ lots may not straddle areas not designated for ride quality testing.

ITEM 402.00004218 PAVEMENT RIDE QUALITY ADJUSTMENT LEVEL 1
ITEM 402.00005218 PAVEMENT RIDE QUALITY ADJUSTMENT LEVEL 2

- Include pavement sections shorter than 264 ft located between a PRQ lot and an area not designated for ride quality testing or the end of the contract in the adjacent PRQ lot.
 - Create separate PRQ lot for pavement sections at least 264 ft long, but less than 528 ft, located between a PRQ lot and an area not designated for ride quality testing or the end of the contract.
 - Remaining areas at the end of a day's paving which are less than 528 ft long will be added to and tested with the adjacent pavement after it is constructed.
- 2. Perform QC Testing.** Perform one test in every PRQ lot in accordance with Test Method NY 402-01F. Perform QC testing after the final surface course has been paved and compacted. Notify the Engineer at least 48 hours in advance of QC testing.
- 3. Report Results.** Provide the following information to the Engineer by the end of the next work day.
- a. IRI Testing Summary Report.** Provide an IRI testing summary report, consisting of a header and results table, to the Engineer as a printout and a computer file. The computer file may be in spreadsheet or ASCII format.
- 1. Header.** Include the following information in the report header.
 - Contract D-number
 - Date
 - Filter Settings
 - 2. Results Table.** Provide a table consisting of 9 columns labeled as shown below and one row for each PRQ lot tested. Report all results in units of in/mi calculated to the nearest 1 in/mi.

| PRQ lot # | Direction | Lane/ Ram P | Begin Station | End Station | Measurement 1 | | Measurement 2 | | Measurement 3 | | Test |
|-----------|-----------|-------------------|------------------|----------------|---------------|-----|---------------|-----|---------------|-----|------|
| | | | | | LWP | RWP | LWP | RWP | LWP | RWP | |
| | | | | | | | | | | | |

- b. Profile Data.** Provide a copy of each profile in the electronic format specified in Test Method NY 402-01F. Name each file according to the following format.

"XXXXXX_YYY_Z.ERD"

- XXXXXX - Reserve first six characters for the numerical portion of the contract number.
- YYY - Separated from the first six characters by an underscore. Reserve the next three characters for the first lot number represented by the file.
- Z - Separated from the previous three characters by an underscore. Reserve the last character for the number of the measurement (1, 2, or 3) represented by the file.
- .ERD - Denotes the file as being in the proper format for evaluation.

- D. Corrective Action.** Present the proposed repair procedures to the Engineer for approval at least 48 hours before beginning the repair work. Pavement thickness, location of repair, level of ride quality, and effectiveness of a proposed procedure will be primary considerations in determining the proposed procedure's acceptability. Repeat the QC testing for the repaired PRQ lot(s) after the repair is completed. The final tests will be used for payment.

ITEM 402.00004218 PAVEMENT RIDE QUALITY ADJUSTMENT LEVEL 1
ITEM 402.00005218 PAVEMENT RIDE QUALITY ADJUSTMENT LEVEL 2

METHOD OF MEASUREMENT

Quality payment adjustments will be measured in Quality Units.

- Determine Quality Units for each PRQ lot by using Table 1.
- For PRQ lots of a length different from 528 ft, adjust the number of Quality Units as follows:

$$\text{Quality Units} = \text{Quality Units from Table 1} \times \left(\frac{\text{length of PRQ lot (ft)}}{528 \text{ ft}} \right)$$

- Determine the total number of Quality Units by summing the Quality Units from all PRQ lots.
- Contract Quality Units will be rounded to the nearest whole unit.

| Table 1 Determination of Quality Units | | | | |
|-------------------------------------------|---------------|----------------------|-----------------------------------|---------------------------------|
| LEVEL 1 | | LEVEL 2 | | |
| PRQ lot IRI (in/mi) | Quality Units | PRQ lot IRI (in/mi) | Quality Units for Multiple-Course | Quality Units for Single-Course |
| < 40 | 8 | < 50 | 8 | 4 |
| 40 - 55 | 4 | 51 - 65 | 4 | 2 |
| 56 - 70 | 0 | 66 - 80 | 0 | 0 |
| 71 - 85 | -4 | 81 - 95 | -4 | -2 |
| 86 - 95 | -8 | 96 - 105 | -8 | -4 |
| > 95 ⁽¹⁾ | -16 | > 105 ⁽¹⁾ | -16 | -8 |

(1) The Department will evaluate the lot to determine if it will remain in place. The level of ride quality, location, traffic volume, and speed limit will be primary considerations in determining if the pavement will remain in place. If the pavement cannot remain in place, repair it according to the procedures under Corrective Action in this specification. If the pavement can remain in place, the Raw Quality Units will be calculated according to Table 1.

BASIS OF PAYMENT

Payment of Quality Units will be made based on the Index Price listed in the contract documents. The index price shown in the itemized proposal for each Quality Unit is considered the price bid. The unit (index) price is NOT to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figure will be disregarded and the original price will be used to determine the total amount bid for the Contract.

Include the cost for all labor, equipment and material to satisfactorily complete the work in the unit price bid for the appropriate surface course HMA Item.

Payment will be made under:

| Item No. | Item | Pay Unit |
|--------------|------------------------------------------|---------------|
| 402.00004218 | Pavement Ride Quality Adjustment Level 1 | Quality Units |
| 402.00005218 | Pavement Ride Quality Adjustment Level 2 | Quality Units |

ITEM 402.00004218 PAVEMENT RIDE QUALITY ADJUSTMENT LEVEL 1
ITEM 402.00005218 PAVEMENT RIDE QUALITY ADJUSTMENT LEVEL 2

DESCRIPTION

Measure the ride quality of the finished riding surface using a verified and properly calibrated inertial profiler. Report test results to the Engineer as an average International Roughness Index (IRI) for the left and right wheelpaths of each pavement-ride-quality (PRQ) lot.

For the purposes of this specification, the following terms are defined below.

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International Roughness Index (IRI). An index computed from a longitudinal profile measurement reported in m/km. IRI is computed according to the quarter-car model which indicates the amount of suspension travel that one wheel of a standard vehicle would experience when traveling over a longitudinal profile.

Measurement. The average determination of IRI along the reference lines (left and right wheelpaths) for the entire length of a single PRQ lot in the direction of traffic.

Multiple-Course. Two or more paving courses, excluding truing and leveling.

Pavement Ride Quality (PRQ) Lot. A PRQ lot is a continuous 200 m section of pavement one lane wide, in areas shown in the contract documents as requiring pavement ride quality testing. Ride Quality testing is performed and payment adjustments are made separately for each PRQ lot.

Quarter-car Model. A mathematical model of one wheel (one quarter) of a car of a standard weight with a standard tire, standard spring rate, and standard damping as established in NCHRP Report 228.

Reference Lines. The imaginary lines the noncontact-height sensors trace along the pavement surface. The intended reference lines for all Quality Control (QC) and Quality Assurance (QA) tests are located approximately 0.9 m to either side of the center line of the lane (left and right wheelpaths). The closer all tests are taken to the same reference lines, the less variability will occur between the results.

Single-Course. One paving course, excluding truing and leveling.

Test. The average of three consecutive measurements taken on the same day in the same PRQ lot by the same inertial profiler and operator.

Verification. All procedures contained in Materials Method 24.1 to be followed to ensure the test results produced by a profiler are within an acceptable variation of the true profile.

MATERIALS None Specified

ITEM 402.00004218 PAVEMENT RIDE QUALITY ADJUSTMENT LEVEL 1

ITEM 402.00005218 PAVEMENT RIDE QUALITY ADJUSTMENT LEVEL 2

CONSTRUCTION DETAILS

Test and report the ride quality of all new flexible pavement and HMA overlays of pavement and bridge decks except:

- sections less than 400 m in length,
- sections within 60 m feet of any traffic control device or intersection,
- tapered sections less than a full lane-width,
- ramps with posted speed less than 40 mph,
- 8 meters from concrete-surfaced bridge decks and approach slabs,
- individual PRQ lots that contain castings, grates, frames or other similar objects embedded within the travel lane – omit the measurement of the wheelpath closest to the object for the one PRQ lot in which it falls,
- shoulders, gore areas, turn-outs, turn-arounds, driveways, parking areas, other similar miscellaneous paving.

All new pavement, including the areas excluded from ride quality testing listed above, is subject to the provisions of §402-3.10 Surface Tolerance.

A. Inertial Profiler Requirements. A self-powered test vehicle conforming to ASTM E950 Class I and AASHTO MP 11-03 containing automated test initiation and data recording systems capable of providing the following information to the on-board display, on-board data storage device, and on-board printer.

- The date, time, contract number, route, location, test direction, lane, and operator for each test.
- The equipment parameters related to calibration.
- A general profile, using a scale of 1:300 horizontal and 1:1 vertical.
- The average IRI and range for both wheelpaths for each PRQ lot.

Alternative equipment types may be used as approved by the Director, Materials Bureau. Submit requests to use alternative equipment at least 14 days prior to the start of QC testing. Alternative equipment must meet the inertial profiler requirements to be approved.

B. Equipment Verification, Calibration, and Daily Control Section Testing.

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- 2. Calibration.** Calibrate the inertial profiler according to frequency and procedures given in Materials Method 24.1.
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C. Quality Control (QC) Measurements.

- 1. Layout PRQ Lots.** Divide the surface-course pavement areas designated in the contract documents as requiring pavement ride quality testing into PRQ lots according to the following:
 - Divide pavement constructed into PRQ lots 200 m long and one lane wide. PRQ lots may include pavement placed on more than one day.
 - Each PRQ lot must be continuous. PRQ lots may not straddle areas not designated for ride quality testing.

ITEM 402.00004218 PAVEMENT RIDE QUALITY ADJUSTMENT LEVEL 1

ITEM 402.00005218 PAVEMENT RIDE QUALITY ADJUSTMENT LEVEL 2

- Include pavement sections shorter than 100 m located between a PRQ lot and an area not designated for ride quality testing or the end of the contract in the adjacent PRQ lot.
 - Create separate PRQ lot for pavement sections at least 100 m long, but less than 200 m, located between a PRQ lot and an area not designated for ride quality testing or the end of the contract.
 - Remaining areas at the end of a day’s paving which are less than 200 m long will be added to and tested with the adjacent pavement after it is constructed.
- 2. Perform QC Testing.** Perform one test in every PRQ lot in accordance with Test Method NY 402-01F. Perform QC testing after the final surface course has been paved and compacted. Notify the Engineer at least 48 hours in advance of QC testing.
- 3. Report Results.** Provide the following information to the Engineer by the end of the next work day.
- a. IRI Testing Summary Report.** Provide an IRI testing summary report, consisting of a header and results table, to the Engineer as a printout and a computer file. The computer file may be in spreadsheet or ASCII format.

1. Header. Include the following information in the report header.

- Contract D-number
- Date
- Filter Settings

2. Results Table. Provide a table consisting of 9 columns labeled as shown below and one row for each PRQ lot tested. Report all results in units of m/km calculated to the nearest 0.01 m/km.

| PRQ lot # | Direction | Lane/ Ramp | Begin Station | End Station | Measurement 1 | | Measurement 2 | | Measurement 3 | | Test |
|-----------|-----------|---------------|------------------|----------------|---------------|-----|---------------|-----|---------------|-----|------|
| | | | | | LWP | RWP | LWP | RWP | LWP | RWP | |
| | | | | | | | | | | | |

b. Profile Data. Provide a copy of each profile in the electronic format specified in Test Method NY 402-01F. Name each file according to the following format.

“XXXXXX_YYY_Z.ERD”

XXXXXX - Reserve first six characters for the numerical portion of the contract number.

YYY - Separated from the first six characters by an underscore. Reserve the next three characters for the first lot number represented by the file.

Z - Separated from the previous three characters by an underscore. Reserve the last character for the number of the measurement (1, 2, or 3) represented by the file.

.ERD - Denotes the file as being in the proper format for evaluation.

D. Corrective Action. Present the proposed repair procedures to the Engineer for approval at least 48 hours before beginning the repair work. Pavement thickness, location of repair, level of ride quality, and effectiveness of a proposed procedure will be primary considerations in determining the proposed procedure’s acceptability. Repeat the QC testing for the repaired PRQ lot(s) after the repair is completed. The final tests will be used for payment.

ITEM 402.00004218 PAVEMENT RIDE QUALITY ADJUSTMENT LEVEL 1
ITEM 402.00005218 PAVEMENT RIDE QUALITY ADJUSTMENT LEVEL 2

METHOD OF MEASUREMENT

Quality payment adjustments will be measured in Quality Units.

- Determine Quality Units for each PRQ lot by using Table 1.
- For PRQ lots of a length different from 200 m, adjust the number of Quality Units as follows:

$$\text{Quality Units} = \text{Quality Units from Table 1} \times \left(\frac{\text{length of PRQ lot (m)}}{200 \text{ m}} \right)$$

- Determine the total number of Quality Units by summing the Quality Units from all PRQ lots.
- Contract Quality Units will be rounded to the nearest whole unit.

| Table 1 Determination of Quality Units | | | | |
|-------------------------------------------|---------------|-----------------------|-----------------------------------|---------------------------------|
| LEVEL 1 | | LEVEL 2 | | |
| PRQ lot IRI (m/km) | Quality Units | PRQ lot IRI (m/km) | Quality Units for Multiple-Course | Quality Units for Single-Course |
| < 0.60 | 10 | < 0.75 | 10 | 5 |
| 0.60 – 0.85 | 5 | 0.75 – 1.00 | 5 | 2.5 |
| 0.86 – 1.10 | 0 | 1.01 – 1.25 | 0 | 0 |
| 1.11 – 1.30 | -5 | 1.26 – 1.45 | -5 | -2.5 |
| 1.31 – 1.50 | -10 | 1.46 – 1.65 | -10 | -5 |
| > 1.50 ⁽¹⁾ | -20 | > 1.65 ⁽¹⁾ | -20 | -10 |

(1) The Department will evaluate the lot to determine if it will remain in place. The level of ride quality, location, traffic volume, and speed limit will be primary considerations in determining if the pavement will remain in place. If the pavement cannot remain in place, repair it according to the procedures under Corrective Action in this specification. If the pavement can remain in place, the Raw Quality Units will be calculated according to Table 1.

BASIS OF PAYMENT

Payment of Quality Units will be made based on the Index Price listed in the contract documents. The index price shown in the itemized proposal for each Quality Unit is considered the price bid. The unit (index) price is NOT to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figure will be disregarded and the original price will be used to determine the total amount bid for the Contract.

Include the cost for all labor, equipment and material to satisfactorily complete the work in the unit price bid for the appropriate surface course HMA Item.

Payment will be made under:

| Item No. | Item | Pay Unit |
|--------------|------------------------------------------|---------------|
| 402.00004218 | Pavement Ride Quality Adjustment Level 1 | Quality Units |
| 402.00005218 | Pavement Ride Quality Adjustment Level 2 | Quality Units |